Electromagnetic Compatibility Test Report

Tests Performed on a New Cosmos Electric Co., Ltd.

Methane Detector Transciever, Model ML-310CE

Radiometrics Document RP-8931

Product Detail:
FCC ID: 2ARF2ML-310 Equipment type: DSS
Test Standards:
US CFR Title 47, Chapter I, FCC Part 15 Subpart C FCC Part 15 CFR Title 47: 2018 This report concerns: Original Grant for Certification FCC Part 15.247

Tests Performed For:	*Test Facility:*
New Cosmos Electric Co., Ltd. 2-5-4 Mitsuya-naka, Yodogawa-ku Osaka 532-0036 Japan	**Radiometrics Midwest Corporation** 12 Devonwood Avenue Romeoville, IL 60446-1349 (815) 293-0772

Test Date(s): (Month-Day-Year)
August 15 thru October 3, 2018

Document RP-8931 Revisions:

Rev.	Issue Date	Affected Sections	Revised By
0	September 26, 2018		
1	October 3, 2018	11.3, 11.8.2, 11.4, 11.9	Joseph Strzelecki
2	October 8, 2018	Cover	Joseph Strzelecki

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1.0 ADMINISTRATIVE DATA

Equipment Under Test:	
A New Cosmos Electric Co. Ltd., Methane Detector Model: ML-310CE Serial Number: none This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics: (Month-Day-Year)	*Test Date(s): (Month-Day-Year)*
August 15, 2018	August 15 thru October 3, 2018
Test Report Written By:	*Test Partially Witnessed By:*
Joseph Strzelecki Senior EMC Engineer	Joe Deluca New Cosmos Electric Co.
Radiometrics' Personnel Responsible for Test:	*Test Report Approved By*
Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2.0 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Methane Detector, Model ML-310CE, manufactured by New Cosmos Electric Co., Ltd. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

Environmental Phenomena	Frequency Range	FCC Section	Test Result
Carrier Frequency Separation	902-928 MHz	15.247 a	Pass
Number of Hopping Frequencies	902-928 MHz	15.247 a	Pass
Time of Occupancy (Dwell Time)	902-928 MHz	15.247 a	Pass
20 dB Bandwidth Test	902-928 MHz	15.247 a	Pass
Peak Output Power	902-928 MHz	15.247 b	Pass
Band-edge Compliance of RF Conducted Emissions	902-928 MHz	15.247 d	Pass
Spurious RF Conducted Emissions	30-9300 MHz	15.247 d	Pass
Spurious Radiated Emissions	30-9300 MHz	15.247 d	Pass

Conducted emissions is not needed since the product is battery powered.

3.0 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a Methane Detector, Model ML-310CE, manufactured by New Cosmos Electric Co., Ltd. The EUT is a methane gas detection system. The EUT was in good working condition during the tests, with no known defects.

3.1.1 FCC Section 15.203 Antenna Requirements

The antennas have a connector type that is not readily available to the general public. The connector is inside the housing and not readily available to the end user. Therefore, it meets the 15.203 Requirements.

4.0 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm or 150 cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations. The EUT was tested as a stand-alone device. Power was supplied by a new 3-volt batteries.

The identification for all equipment, plus descriptions of all cables used in the tested system, are:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	Methane Detector	E	New Cosmos Electric Co., Ltd.	ML-310CE	None

* Type: E = EUT

4.2 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

4.3 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

5.0 TEST SPECIFICATIONS

Document	Date	Title
FCC CFR Title 47	2018	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices

6.0 TEST PROCEDURE DOCUMENTS

The tests were performed using the procedures from the following specifications:

Document	Date	Title
ANSI C63.4-2014	2014	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	2013	American National Standard for Testing Unlicensed Wireless Devices

7.0 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 2005 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the test methods listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.org).

The following is a list of shielded enclosures located in Romeoville, Illinois used during the tests:

Chamber E: Is a custom made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber. The floor has a 9' x 9' section of microwave absorber for testing above 1 GHz.

A separate ten-foot long, brass plated, steel ground rod attached via a 6-inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

The FCC has accepted these sites as test site number US1065. The FCC test site Registration Number is 732175.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance to ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

8.0 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

9.0 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification and the data contained herein was taken with calibrated test equipment. The results relate only to the EUT listed herein.

10.0 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	01/17/18
ANT-04	Tensor	Biconical Antenna	4104	2246	20-250MHz	24 Mo.	01/24/18
ANT-06	EMCO	Log-Periodic Ant.	3146	1248	200-1000MHz	24 Mo.	12/05/17
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	12/28/16
CAB-106A	Teledyne	Coaxial Cable	N/A	1090	DC-2 GHz	24 Mo.	05/07/18
CAB-1090	Teledyne	Coaxial Cable	N/A	1090	DC-18 GHz	24 Mo.	05/16/18
CAB-160B	Teledyne	Coaxial Cable	N/A	1090	DC-18 GHz	24 Mo.	05/09/18
HPF-07	Mini-Circuits	High Pass Filter	VHF-1500+	31121	1.7-10 GHz	24 Mo.	04/04/18
REC-20	HP / Agilent	Spectrum Analyzer	85460A/84562A	33330A00135 3410A00178	30Hz-6GHz	24 Mo.	08/03/17
REC-21	Agilent	Spectrum Analyzer	E7405A	MY45118341	9Hz-26.5 GHz	24 Mo.	01/06/18

Note: All calibrated equipment is subject to periodic checks.

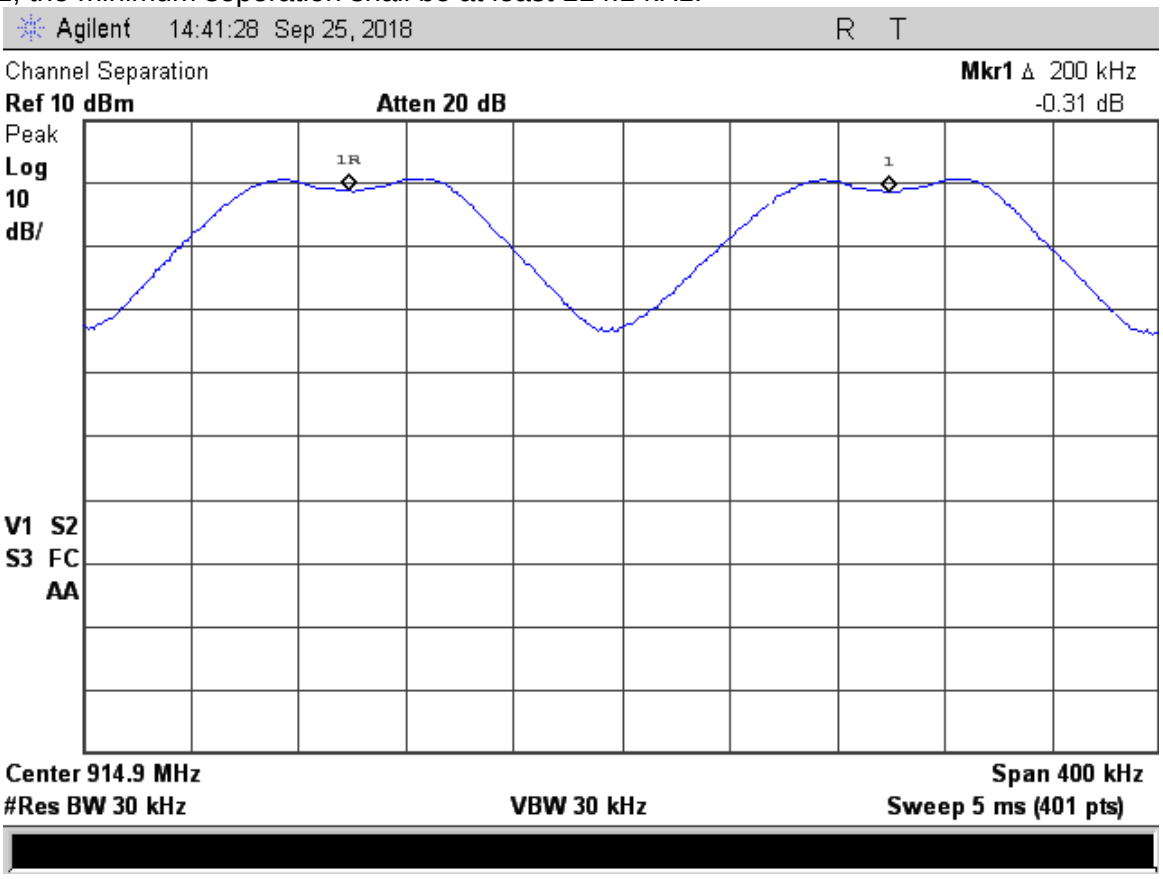
Software Company	Test Software Name	Version	Applicable Tests
Radiometrics	REREC11D	04.19.17	RF Radiated Emissions (FCC Part 15)
Agilent	PSA/ESA-E/L/EMC	2.4.0.42	Bandwidth and screen shots

11.0 TEST SECTIONS

11.1 Carrier Frequency Separation

The EUT has its hopping function enabled. The spectrum analyzer was set to the MAX HOLD mode to read peak emissions. The sweep was set to AUTO. The trace was allowed to stabilize. The marker-delta function was used to determine the separation between the peaks of the adjacent channels.

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Since the 20 dB bandwidth is 114.1 kHz, the minimum seperation shall be at least 114.1 kHz.

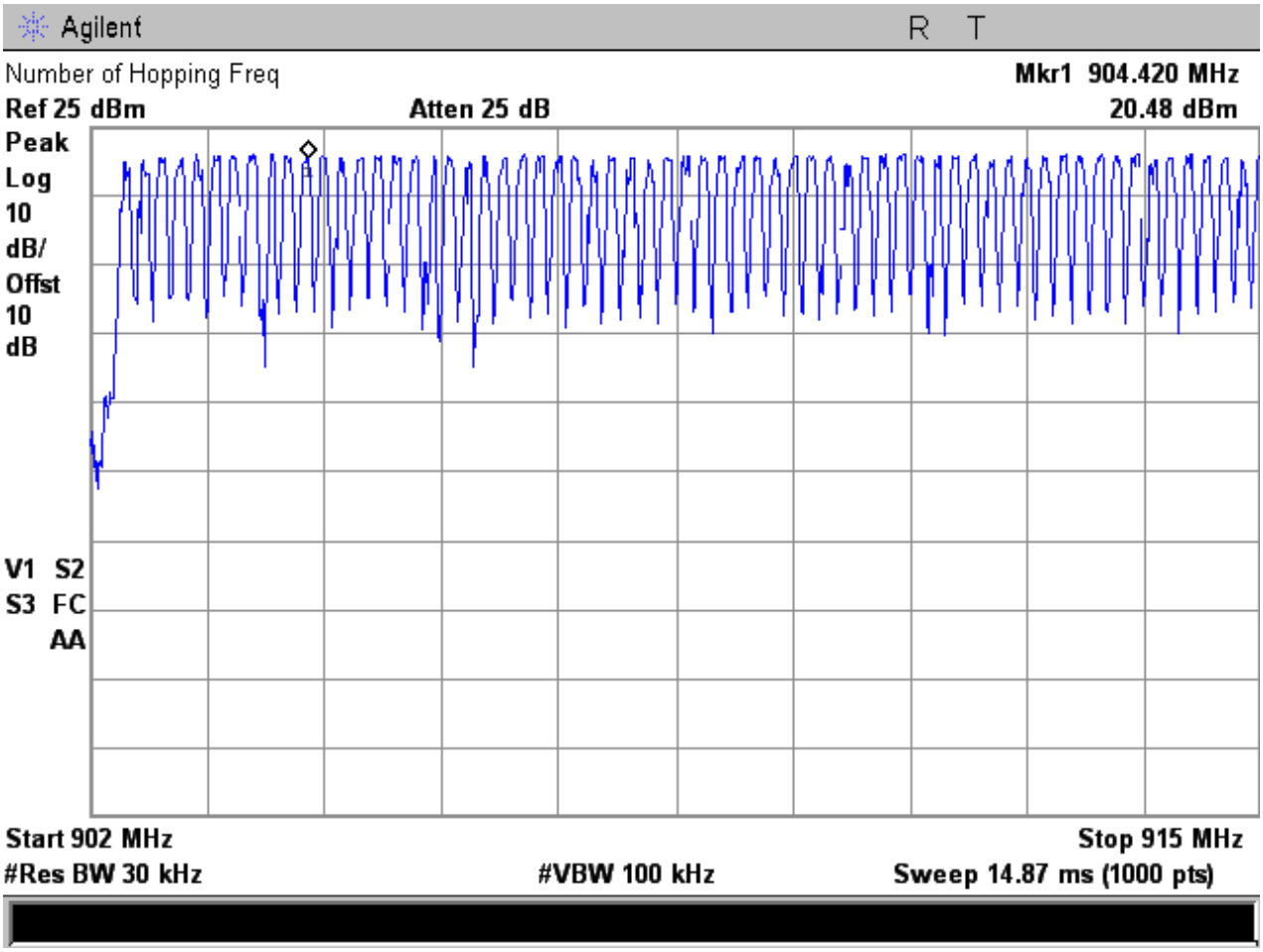


Test result: Freq separation is 200 kHz; Limit is 114.1 kHz

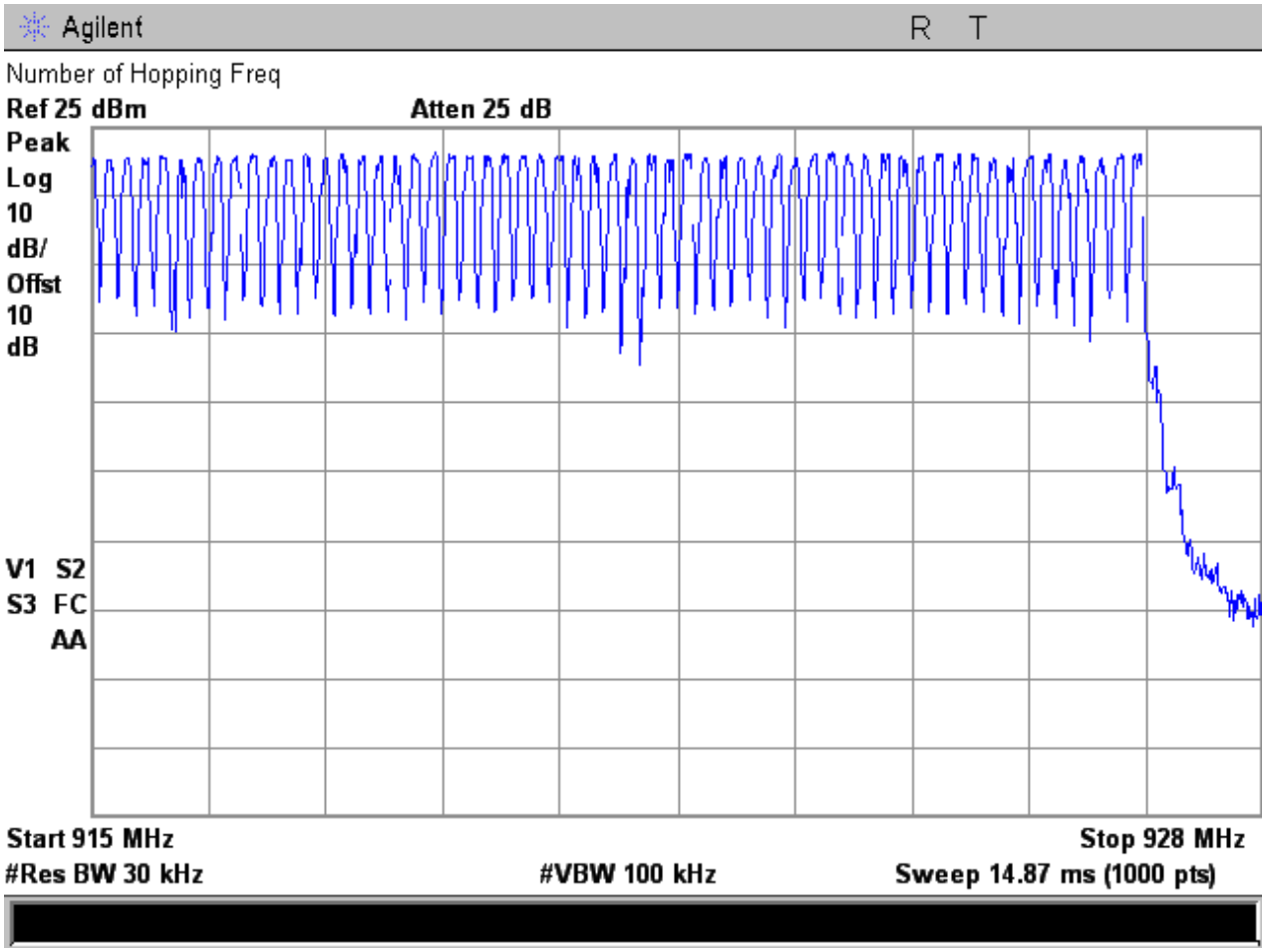
Judgement: Pass

11.2 Number of Hopping Frequencies

The EUT has its hopping function enabled. The spectrum analyzer was set to the MAX HOLD mode to read peak emissions. The sweep was set to AUTO. The trace was allowed to stabilize.



63 hopping frequencies



59 hopping frequencies

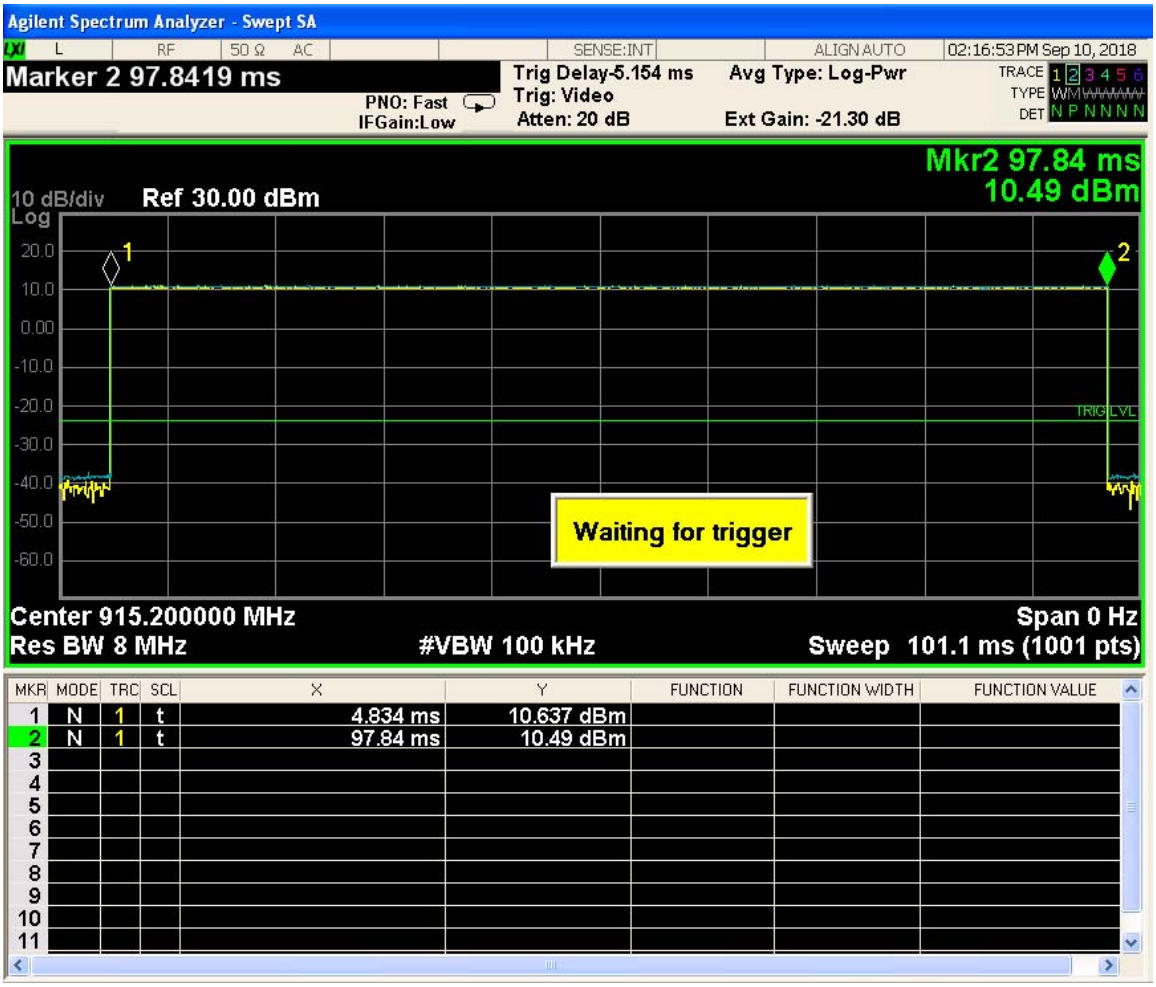
Test result: 122 total Channels

The EUT uses 122 channels and the rules state there must be at least 50 Channels.
Judgement: Pass

11.3 Time of Occupancy (Dwell Time)

The EUT has its hopping function enabled. The spectrum analyzer was set to the MAX HOLD mode to read peak emissions. The span was set to zero. The marker-delta function to determine the dwell time.

The spectrum analyzer was connected to the antenna port. The test procedures are in accordance with ANSI C63.10 section 7.8.4.



Test result: 97.84-4.834 mSec = 93.006 mSec per 20 seconds. It will not transmit more than once per 20 Seconds.

In accordance with FCC 15.247(a)(1)(i), The time of occupancy should be less than 400 mSec in a period of 20 seconds.

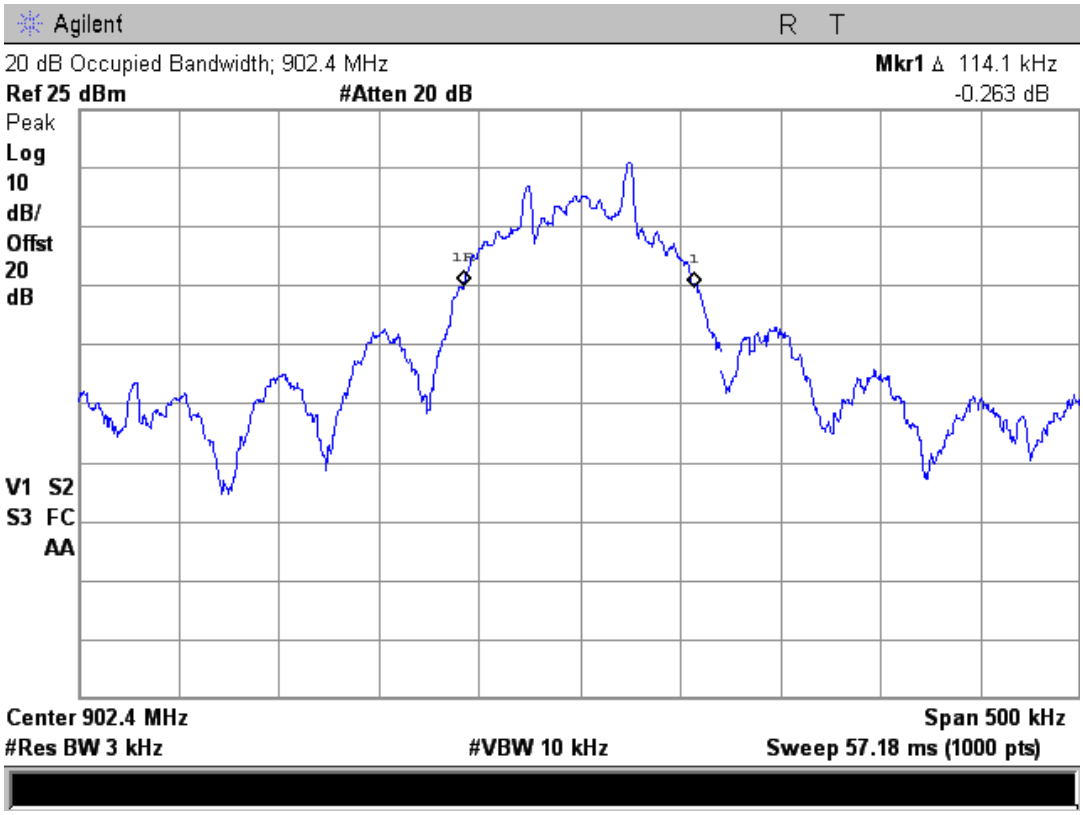
Judgement: Pass

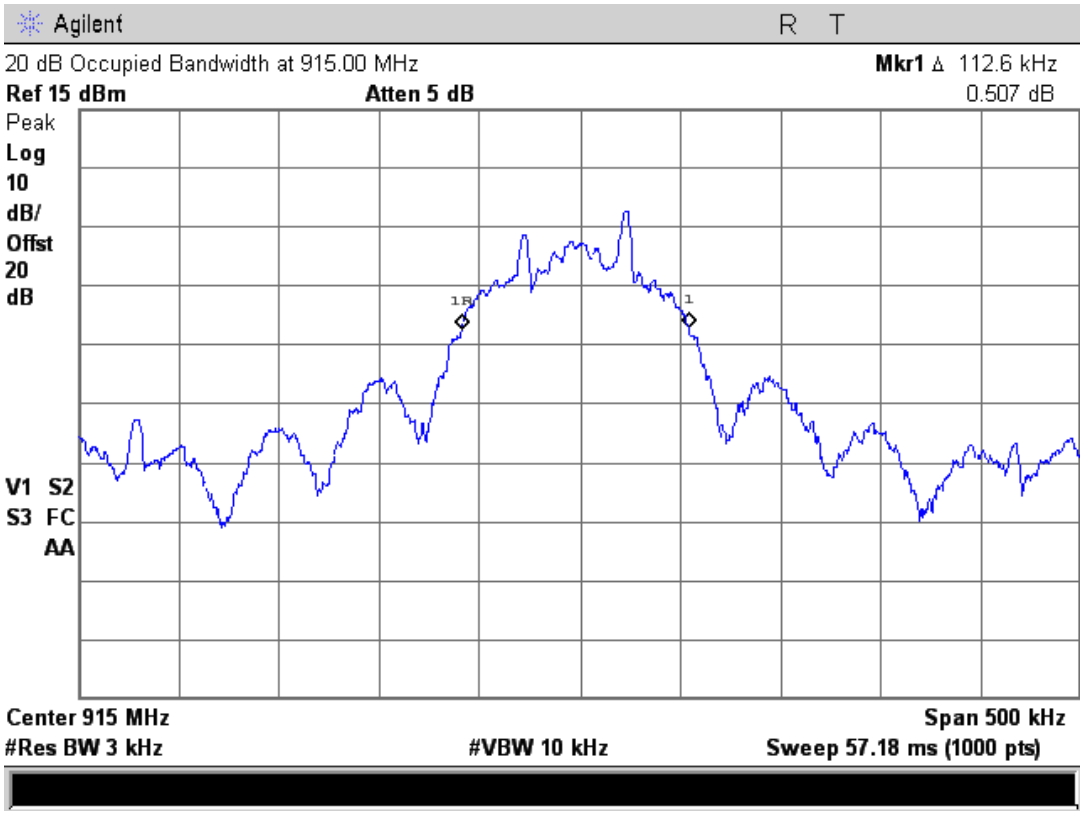
11.4 Occupied Bandwidth Data

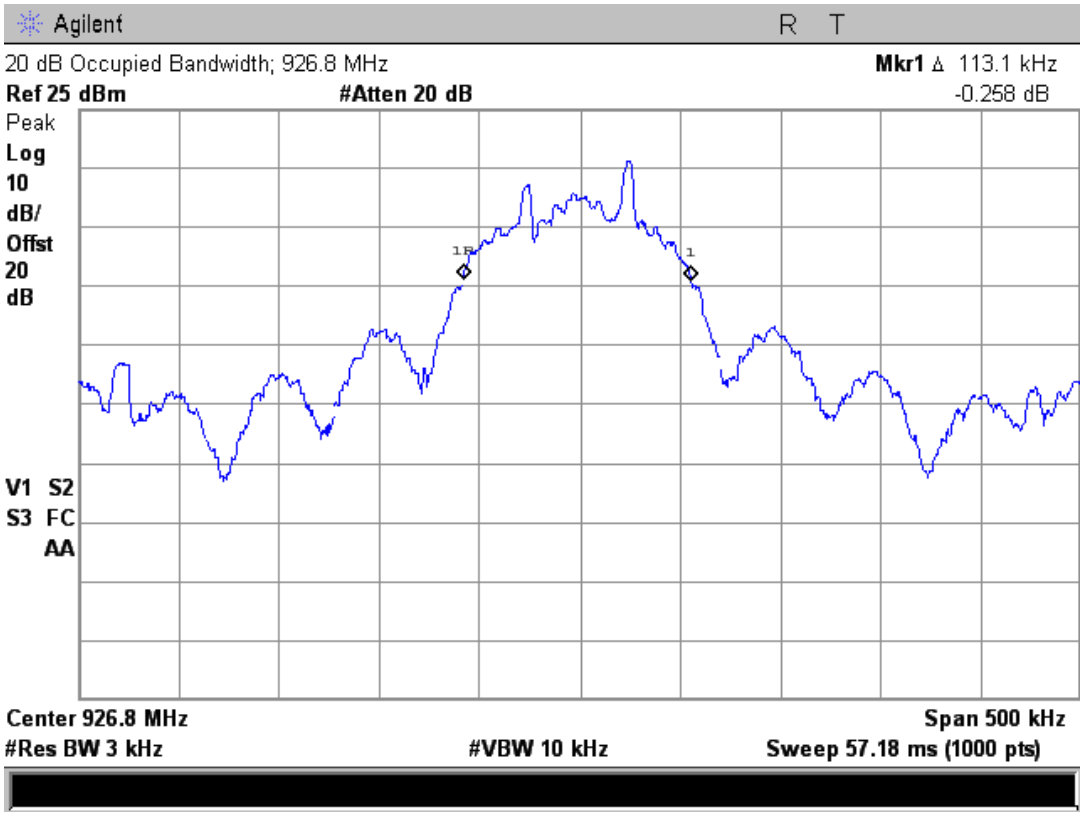
The occupied bandwidth of the RF output was measured using a spectrum analyzer. The bandwidth was measured using the peak detector function and a narrow resolution bandwidth. A broadband antenna was used to receive the modulated signal. The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The spectrum analyzer display was digitized and plotted. The plots of the occupied bandwidth for the EUT are supplied on the following page.

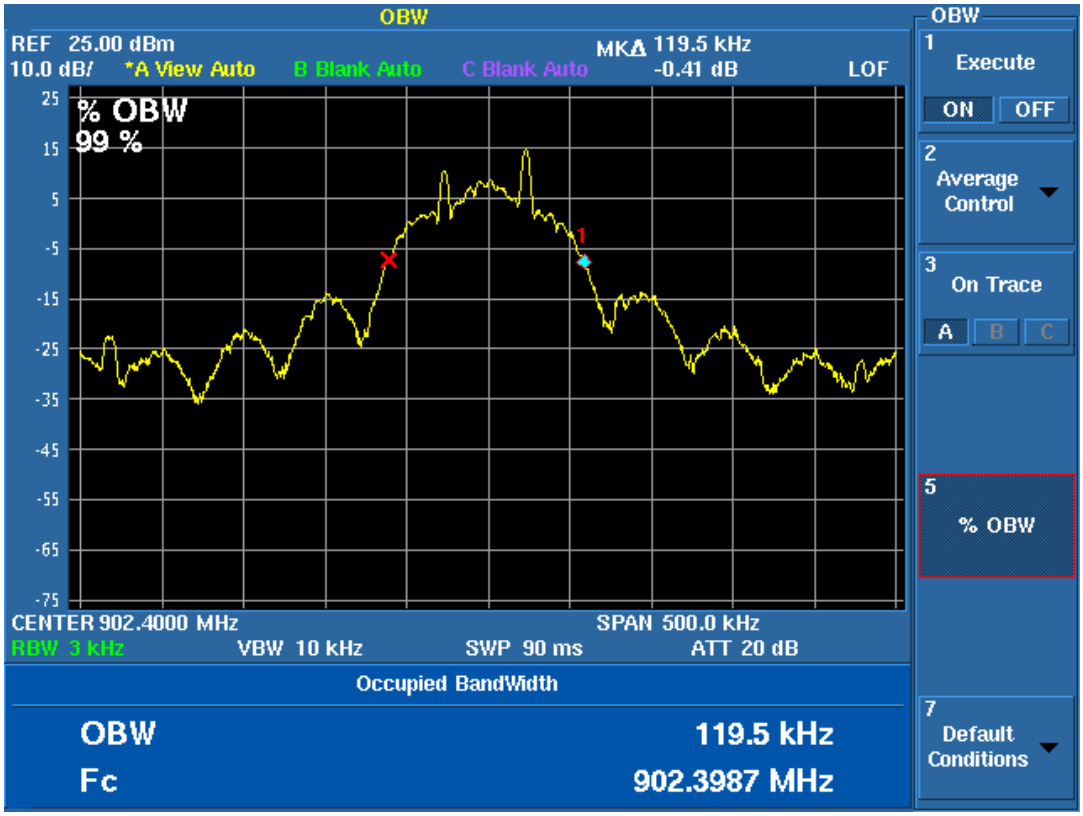
Channel	99% EBW kHz	20 dB EBW kHz
902.40	119.5	114.1
915.00	117.5	112.6
926.80	119.0	113.1

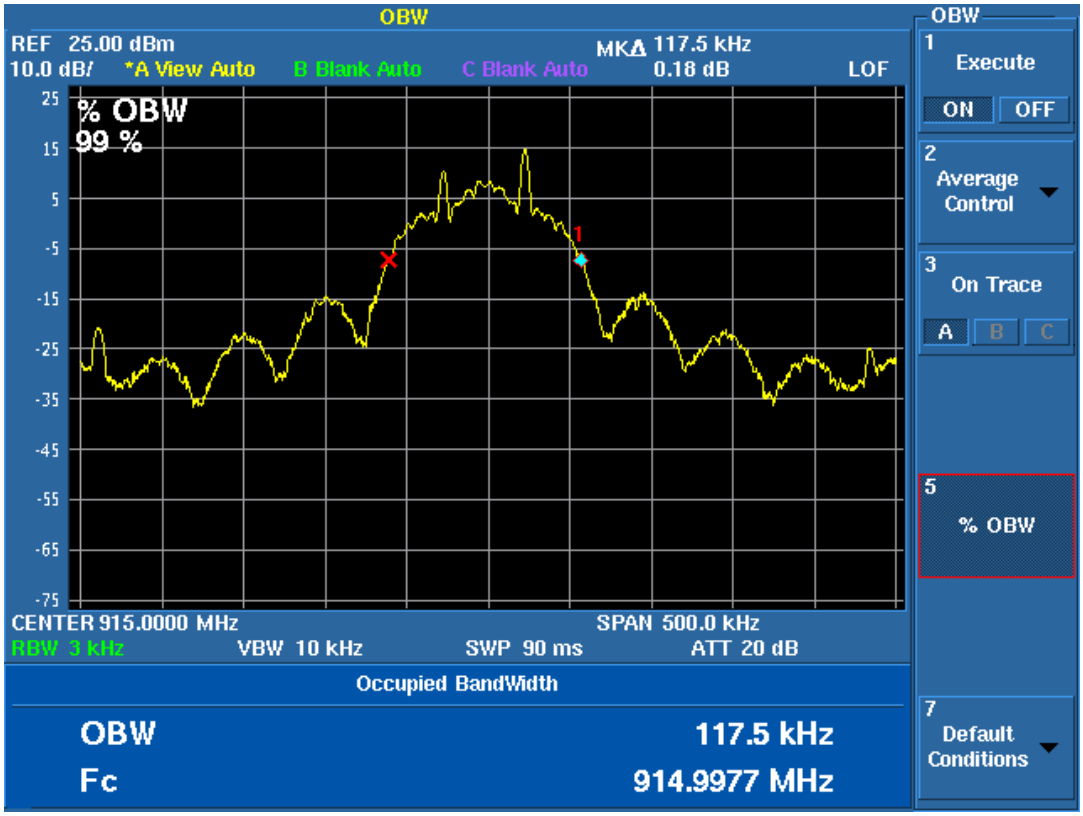
Figure 1. Occupied Bandwidth Plots

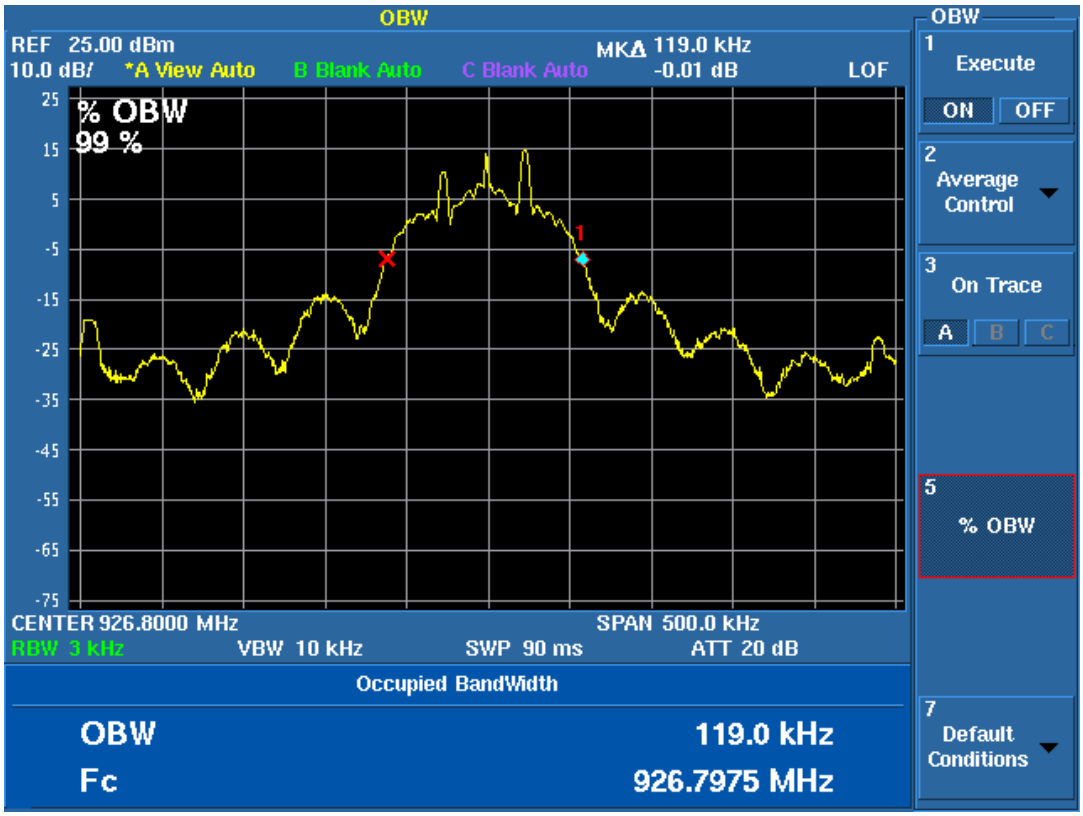





Agilent
R T
20 dB Occupied Bandwidth; 926.8 MHz
Mkr1 Δ 113.1 kHz
Ref 25 dBm
#Atten 20 dB
-0.258 dB
Peak
Log
10
dB/
Offst
20
dB
V1 S2
S3 FC
AA
Center 926.8 MHz
Span 500 kHz
#Res BW 3 kHz
#VBW 10 kHz
Sweep 57.18 ms (1000 pts)


OBW
REF 25.00 dBm
MKΔ 119.5 kHz
10.0 dB/
*A View Auto
B Blank Auto
C Blank Auto
-0.41 dB
LOF
% OBW
99 %
CENTER 902.4000 MHz
SPAN 500.0 kHz
RBW 3 kHz
VBW 10 kHz
SWP 90 ms
ATT 20 dB
Occupied BandWidth
OBW
119.5 kHz
Fc
902.3987 MHz
OBW
1 Execute
ON OFF
2 Average Control
3 On Trace
A B C
5 % OBW
7 Default Conditions


OBW
REF 25.00 dBm
10.0 dB/ *A View Auto B Blank Auto C Blank Auto
MKΔ 117.5 kHz
0.18 dB
LOF
% OBW
99 %
CENTER 915.0000 MHz
SPAN 500.0 kHz
RBW 3 kHz
VBW 10 kHz
SWP 90 ms
ATT 20 dB
Occupied BandWidth
OBW 117.5 kHz
Fc 914.9977 MHz
OBW
1 Execute
ON OFF
2 Average Control
3 On Trace
A B C
5 % OBW
7 Default Conditions


OBW
REF 25.00 dBm
10.0 dB/ *A View Auto B Blank Auto C Blank Auto
MKΔ 119.0 kHz
-0.01 dB
LOF
% OBW
99 %
CENTER 926.8000 MHz
SPAN 500.0 kHz
RBW 3 kHz
VBW 10 kHz
SWP 90 ms
ATT 20 dB
Occupied BandWidth
OBW 119.0 kHz
Fc 926.7975 MHz
OBW
1 Execute
ON OFF
2 Average Control
3 On Trace
A B C
5 % OBW
7 Default Conditions

11.5 Peak Output Power

The EUT antenna port was connected to the Spectrum analyzer Via a low loss coaxial cable. The power output test method from ANSI C63.10 section 12.3.1 was used for this test. Trace averaging was not used. The EUT was transmitting continously. The spectrum analyzer was set to the following settings:

Span = 5 MHz; RBW = 1 MHz; VBW = 3 MHz; Sweep = auto
Detector function = peak; Trace = max hold

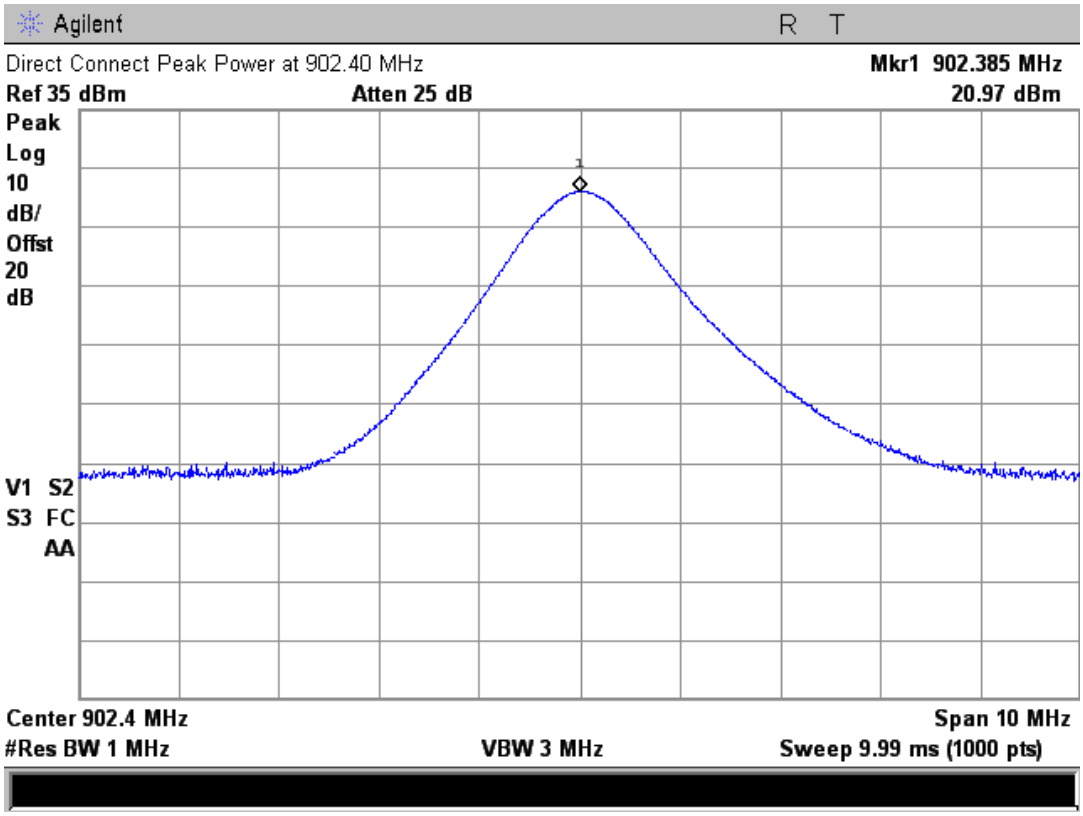
The trace was allowed to stabilize. The indicated level is the peak output power. Since the gain of the antenna is less than 6 dB, the limit is not reduced.

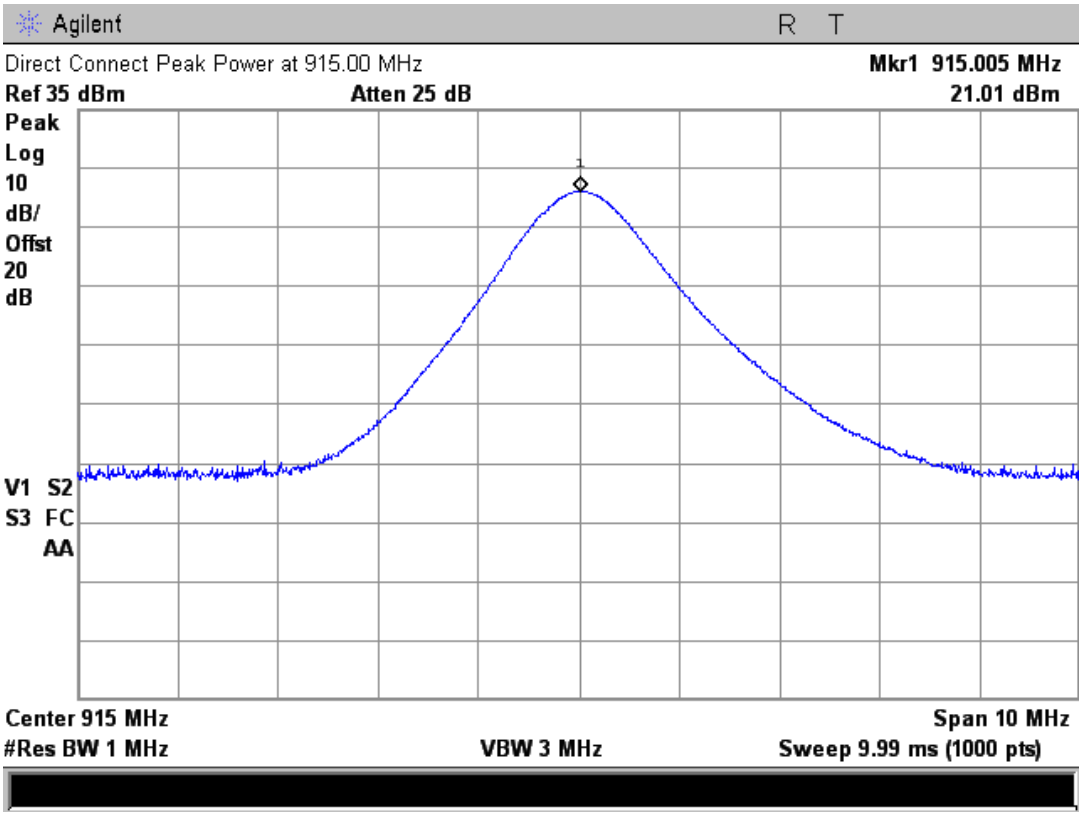
Tested by: Joseph Strzelecki/Richard Tichgelaar
Test Date: 09/18/2018

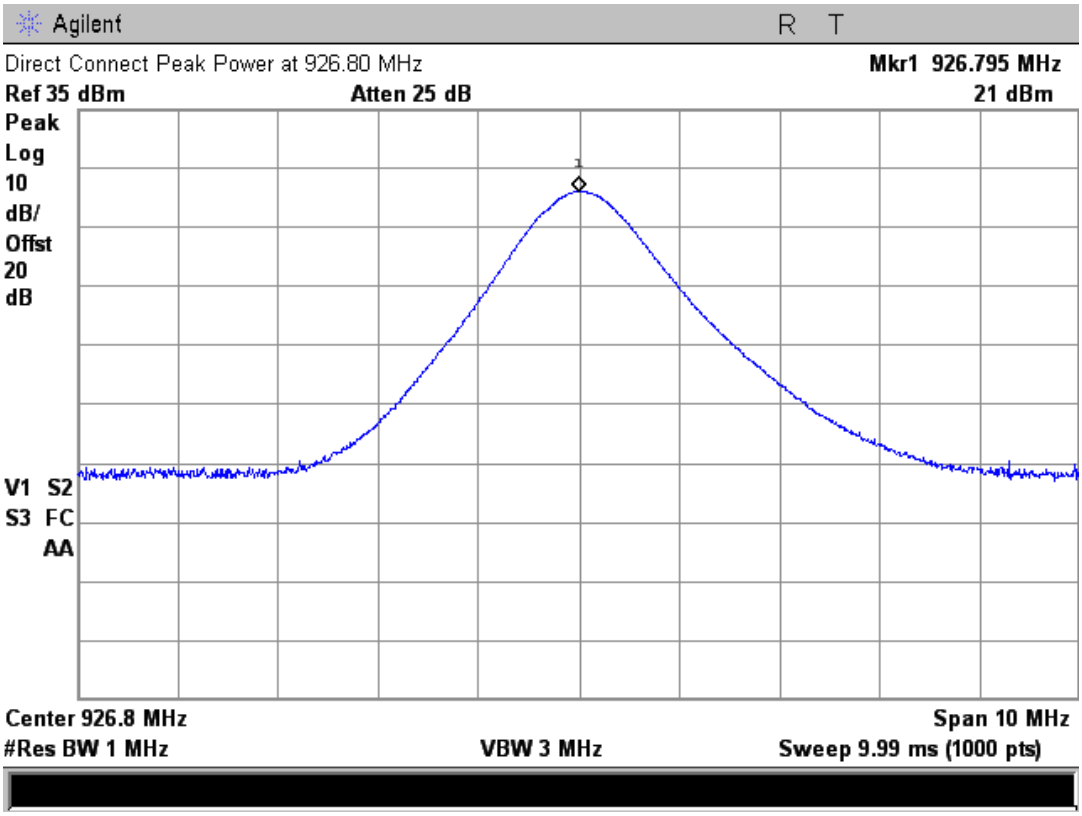
Frequency (MHz)	Reading (dBm)	Cable Loss (dB)	Total Power (dBm)		Limit (dBm)
			dBm	Watts	
902.4	21.0	0.2	21.3	0.1349	30.0
915.0	21.0	0.2	21.3	0.1349	30.0
926.8	21.0	0.2	21.3	0.1349	30.0

Judgment: Passed by 8.7 dB

Tested by: Joseph Strzelecki, Richard Tichgelaar
Test Date: 09/19/2018




Agilent
R T
Direct Connect Peak Power at 915.00 MHz
Mkr1 915.005 MHz
Ref 35 dBm
Atten 25 dB
21.01 dBm
Peak
Log
10
dB/
Offst
20
dB
V1 S2
S3 FC
AA
Center 915 MHz
Span 10 MHz
#Res BW 1 MHz
VBW 3 MHz
Sweep 9.99 ms (1000 pts)


Agilent
R T
Direct Connect Peak Power at 926.80 MHz
Mkr1 926.795 MHz
Ref 35 dBm
Atten 25 dB
21 dBm
Peak
Log
10
dB/
Offst
20
dB
V1 S2
S3 FC
AA
Center 926.8 MHz
Span 10 MHz
#Res BW 1 MHz
VBW 3 MHz
Sweep 9.99 ms (1000 pts)

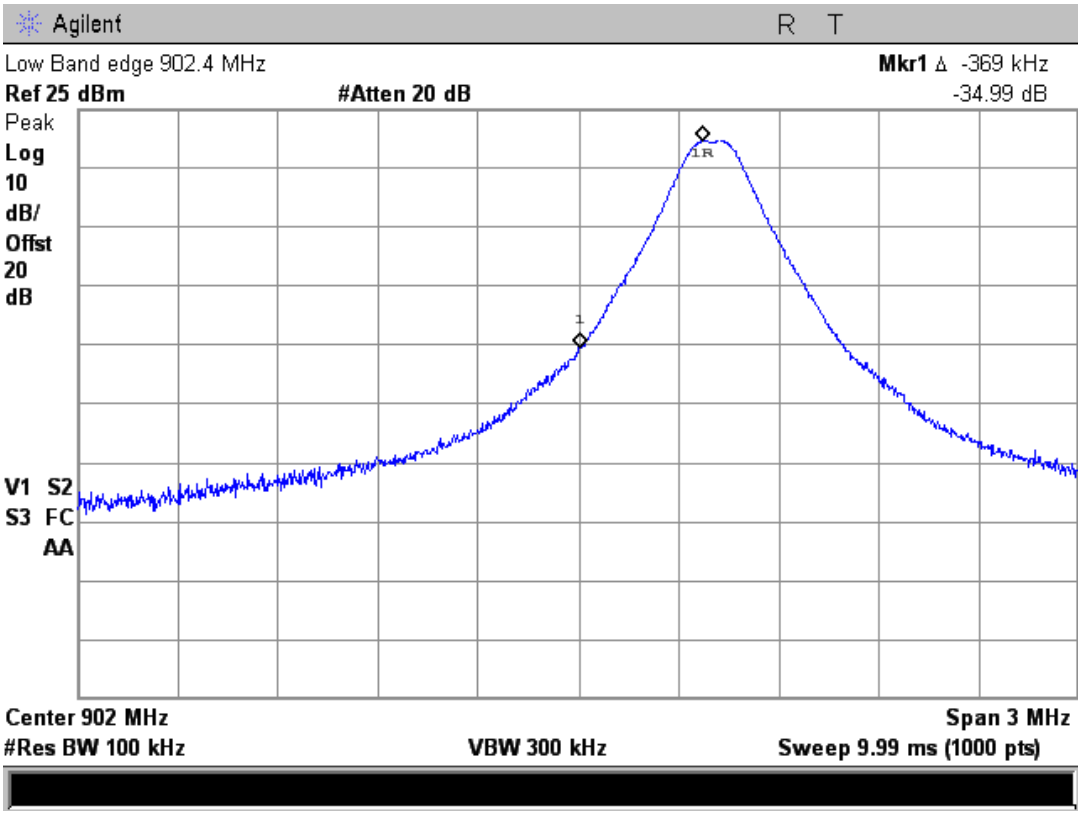
11.6 Band-edge Compliance of RF Conducted Emissions

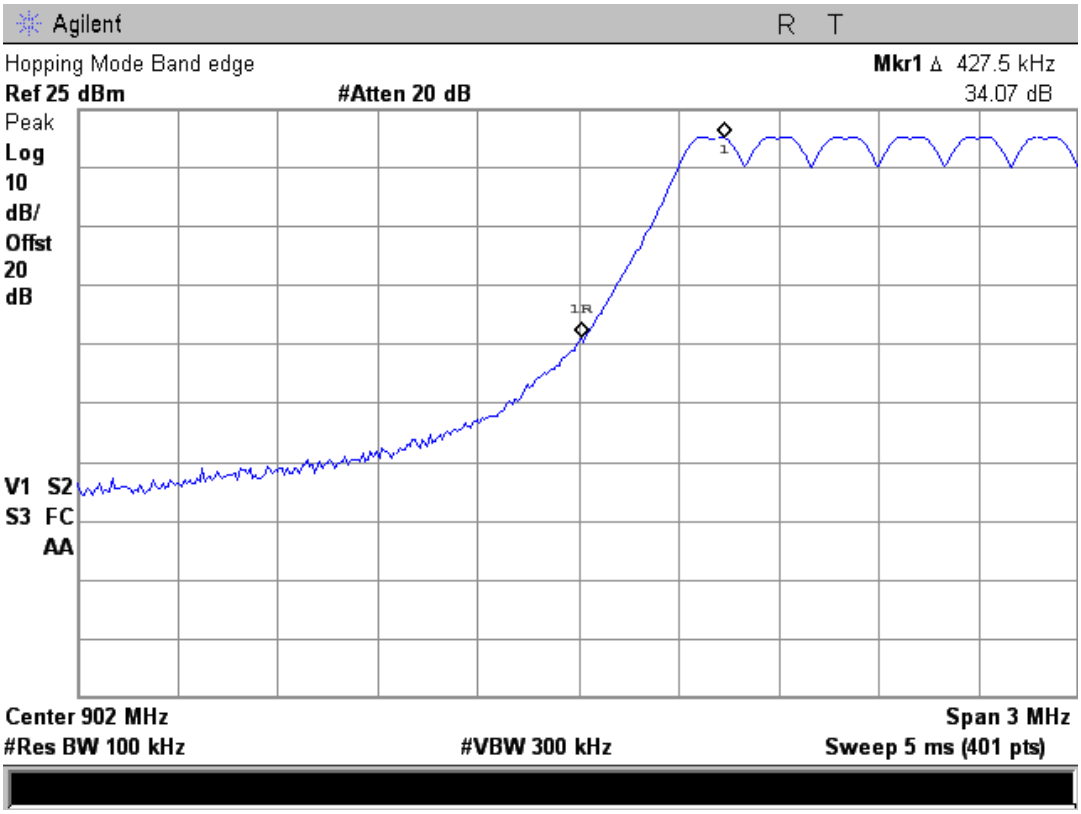
The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation at the band-edge, with the EUT set to the lowest frequency. The trace was allowed to stabilize.

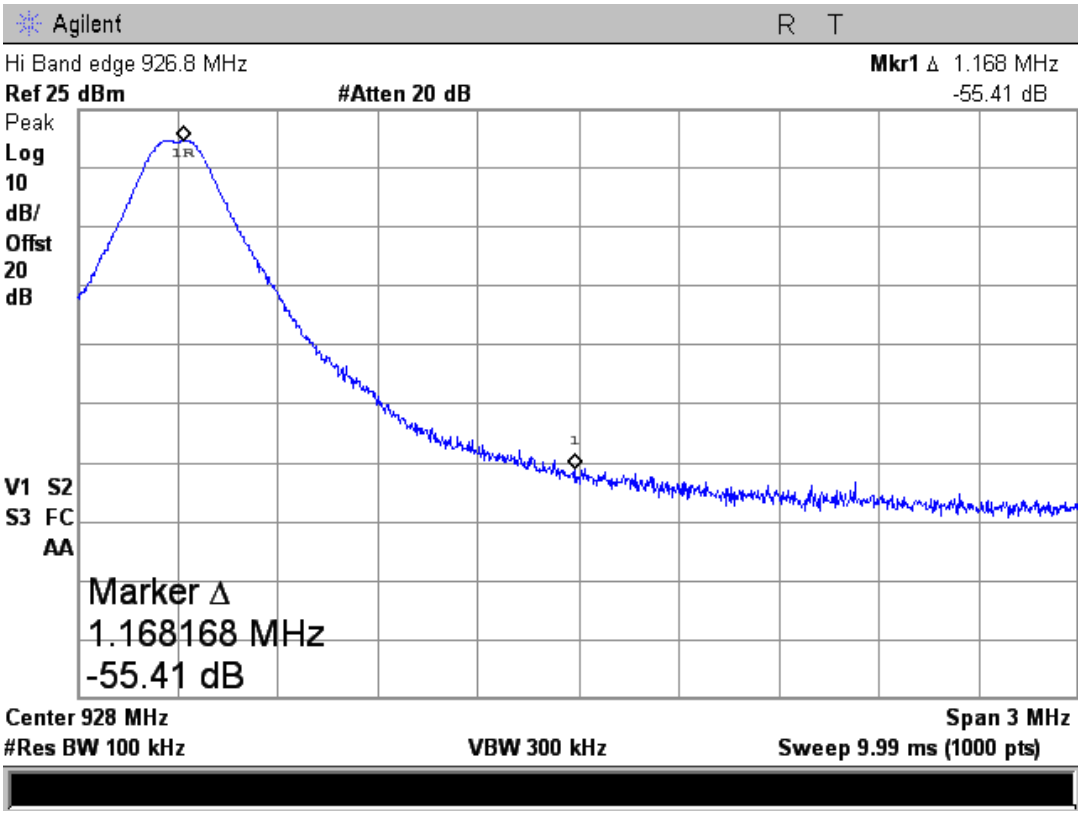
Tested by: Richard Tichgelaar
Test Date: September 19 and October 3, 2018

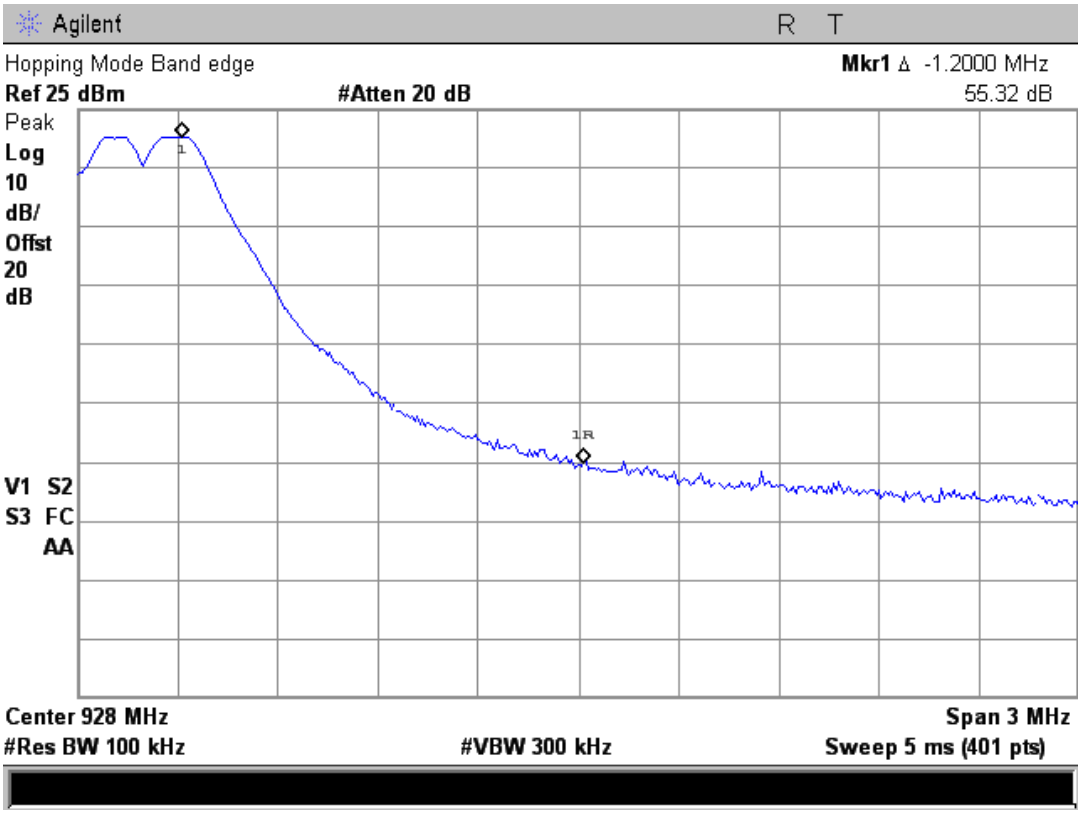
Channel	Reading at Band Edge			Minimum Allowed
	Freq. (MHz)	Non Hopping Delta (dB)	Hopping Delta (dB)	dB
902.4 Lower Band edge	902.0	35.0	34.1	20
926.8 Upper Band edge	928.0	55.4	55.3	20

Judgment: Passed by 14.1 dB




Agilent
R T
Hopping Mode Band edge
Mkr1 Δ 427.5 kHz
Ref 25 dBm
#Atten 20 dB
34.07 dB
Peak
Log
10
dB/
Offst
20
dB
V1 S2
S3 FC
AA
Center 902 MHz
Span 3 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 5 ms (401 pts)


Agilent
R T
Hi Band edge 926.8 MHz
Mkr1 Δ 1.168 MHz
Ref 25 dBm
#Atten 20 dB
-55.41 dB
Peak
Log
10
dB/
Offst
20
dB
V1 S2
S3 FC
AA
Marker Δ
1.168168 MHz
-55.41 dB
Center 928 MHz
Span 3 MHz
#Res BW 100 kHz
VBW 300 kHz
Sweep 9.99 ms (1000 pts)

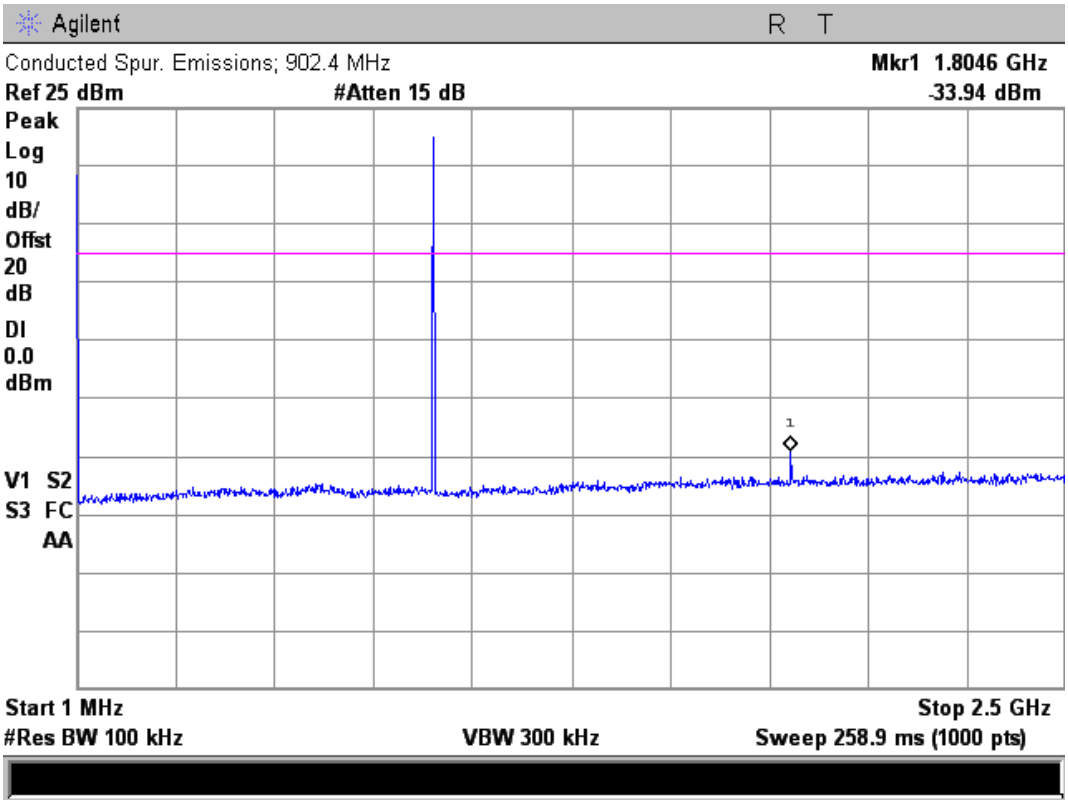


11.7 Spurious RF Conducted Emissions at Antenna Port

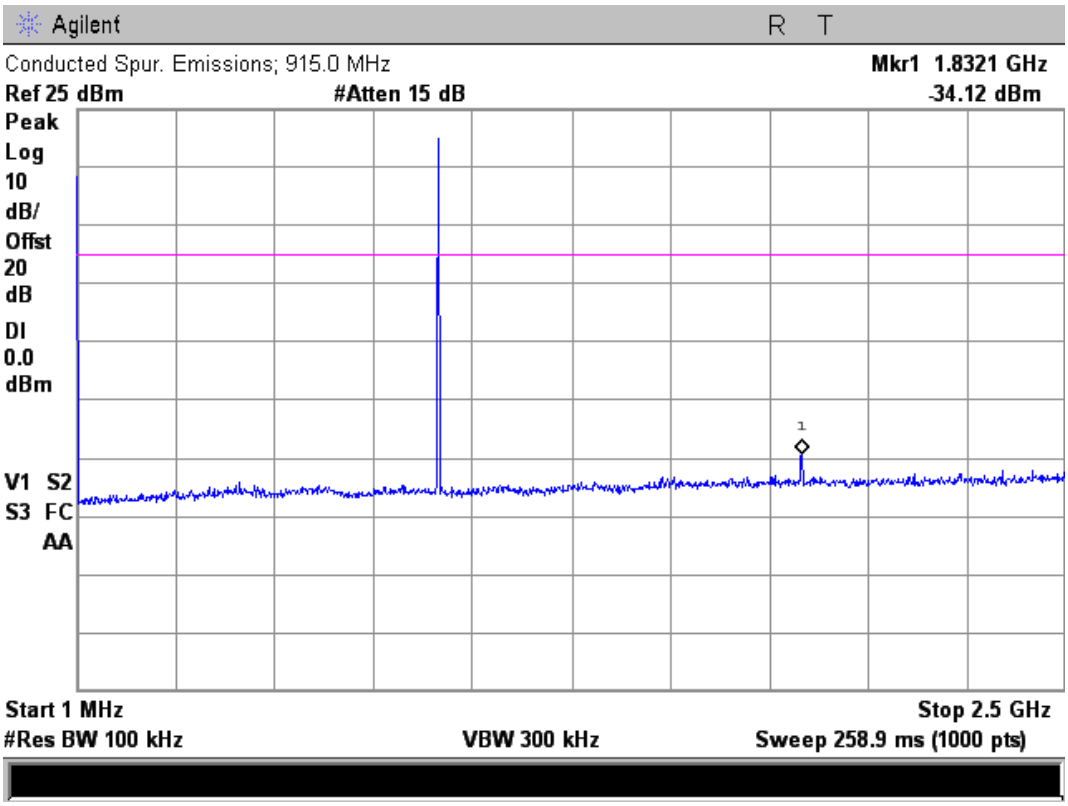
The spectrum analyzer was set to the MAX HOLD mode to record all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic. The trace was allowed to stabilize. The first two plots were made while stepping through three frequencies (Low middle and high). Each frequency was on for 30 seconds. The red dislplay line was set to 20 dB below the level of the fundamental.

Tested by: Joseph Strzelecki/ Richard Tichgelaar
Test Date: September 19, 2018

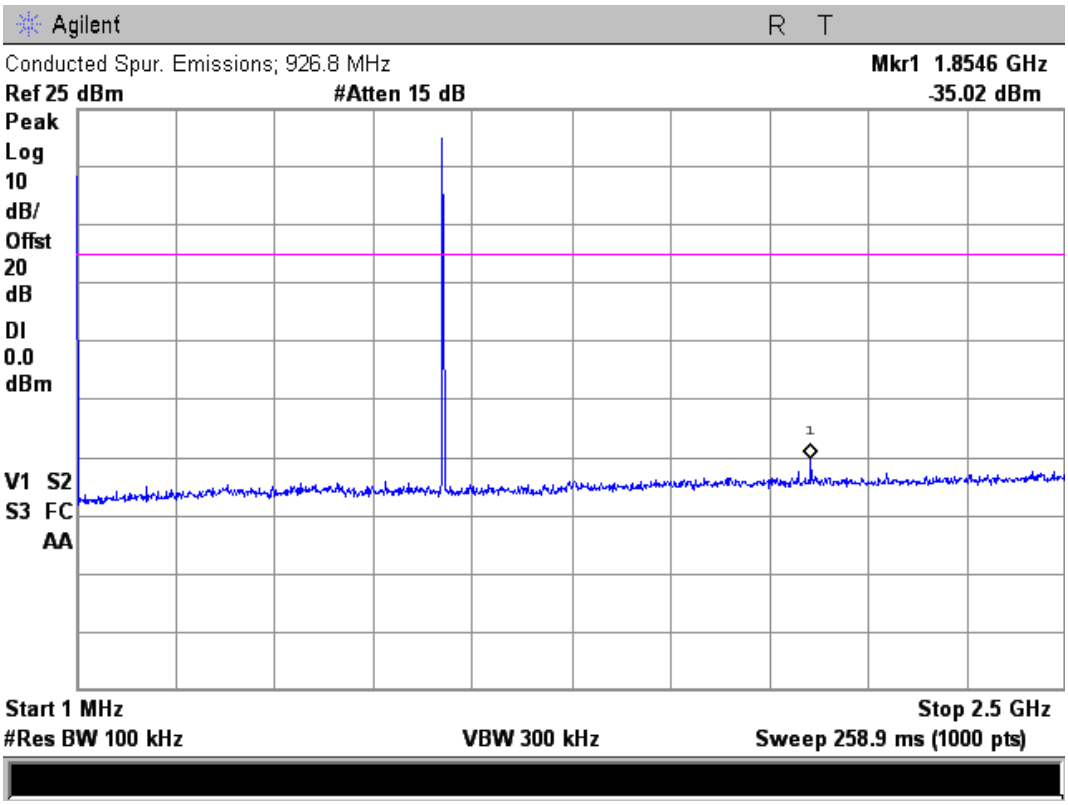
The pink Display Line on all plots was set to 20 dB below the level of the carrier.



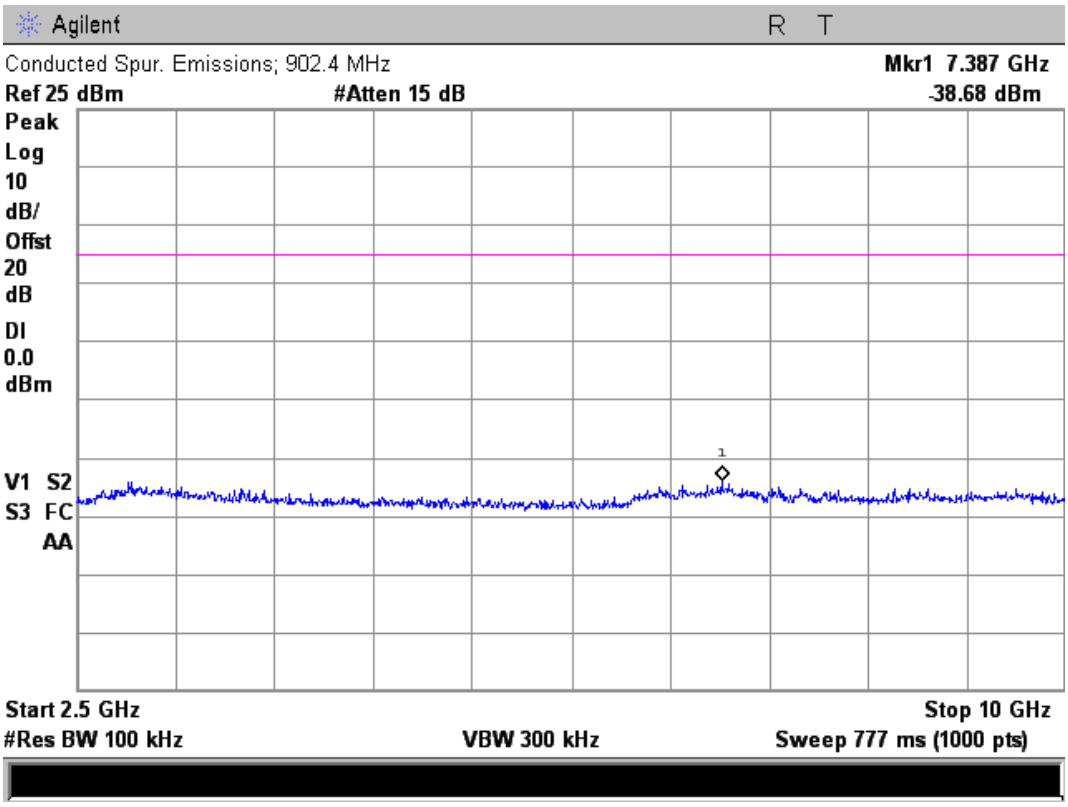
1 MHz to 2.5 GHz (902.4 MHz)



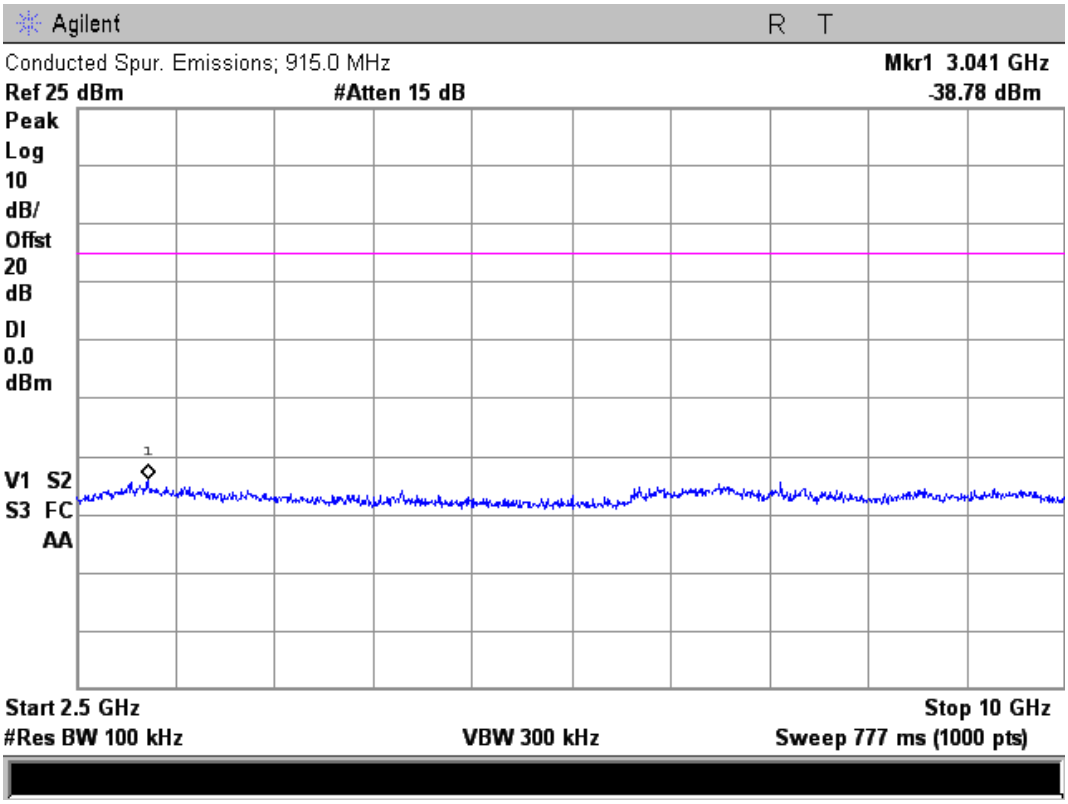
1 MHz to 2.5 GHz (915 MHz)



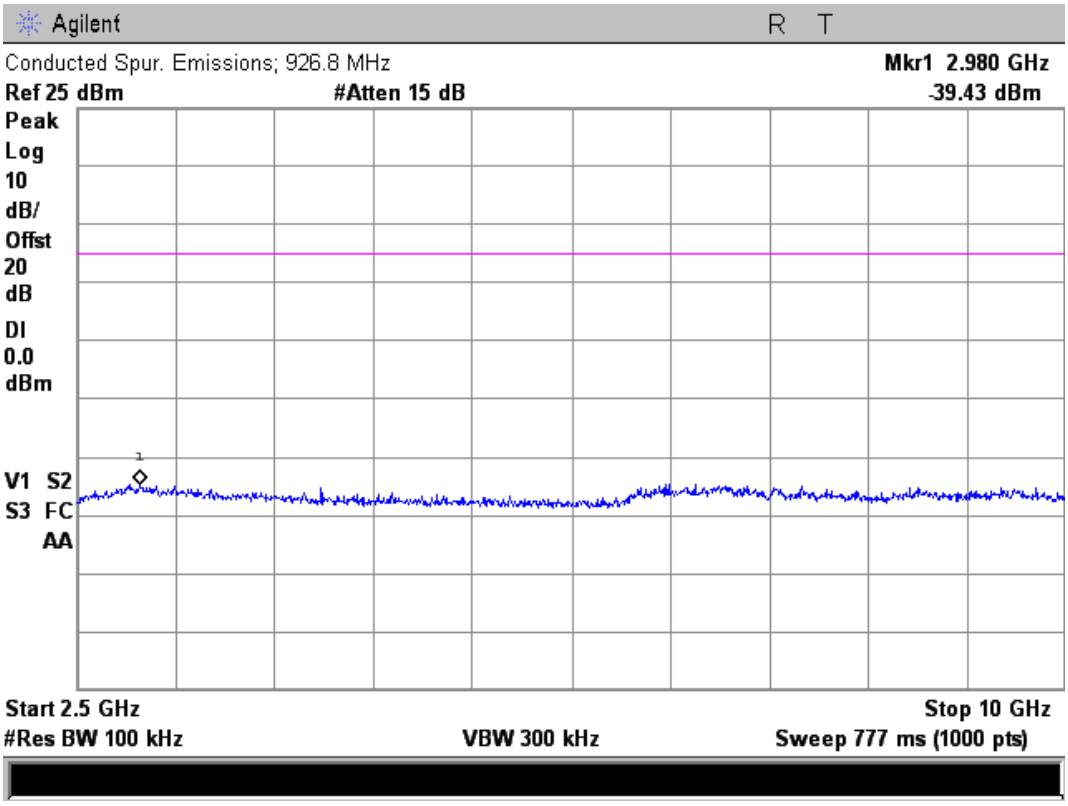
1 MHz to 2.5 GHz (926.8 MHz)



2.5 to 10 GHz (902.4 MHz)



2.5 to 10 GHz (915 MHz)



2.5 to 10 GHz (926.8 MHz)

Judgement: Pass by at least 10 dB

11.8 Radiated RF Emissions

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. The radiated emission measurements were performed with a spectrum analyzer. The bandwidth used from 150 kHz to 30 MHz is 9 or 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. Above 1 GHz, a 1 MHz bandwidth is used. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists. A harmonic mixer was used from 18 to 25 GHz. Figure 4 herein lists the details of the test equipment used during radiated emissions tests.

In addition, a high pass filter was used to reduce the fundamental emission. The EUT was rotated through three orthogonal axis as per 5.10.1 of ANSI C63.10 during the radiated tests.

Final radiated emissions measurements were performed inside of an anechoic chamber at a test distance of 3 meters. The anechoic chamber is designated as Chamber E. This Chamber meets the Site Attenuation requirements of ANSI C63.4 and CISPR 16-1. Chamber E is located at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

The entire frequency range from 30 to 9300 MHz was slowly scanned with particular attention paid to those frequency ranges which appeared high. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded. All measurements may be performed using either the peak, average or quasi-peak detector functions. If the peak detector data exceeds or is marginally close to the limits, the measurements are repeated using a quasi-peak detector or average function as required by the specification for final determination of compliance.

The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground.

11.8.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

FS = RA + AF + CF - AG + HPF + PKA

Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain
HPF = High pass Filter Loss

Note: The actual FCC limits are in uV/m. The data in the results table coverted the limits to dBuV/m.
100 uV/m = 40.0 dBuV/m
150 uV/m = 43.5 dBuV/m
200 uV/m = 46.0 dBuV/m
500 uV/m = 54.0 dBuV/m

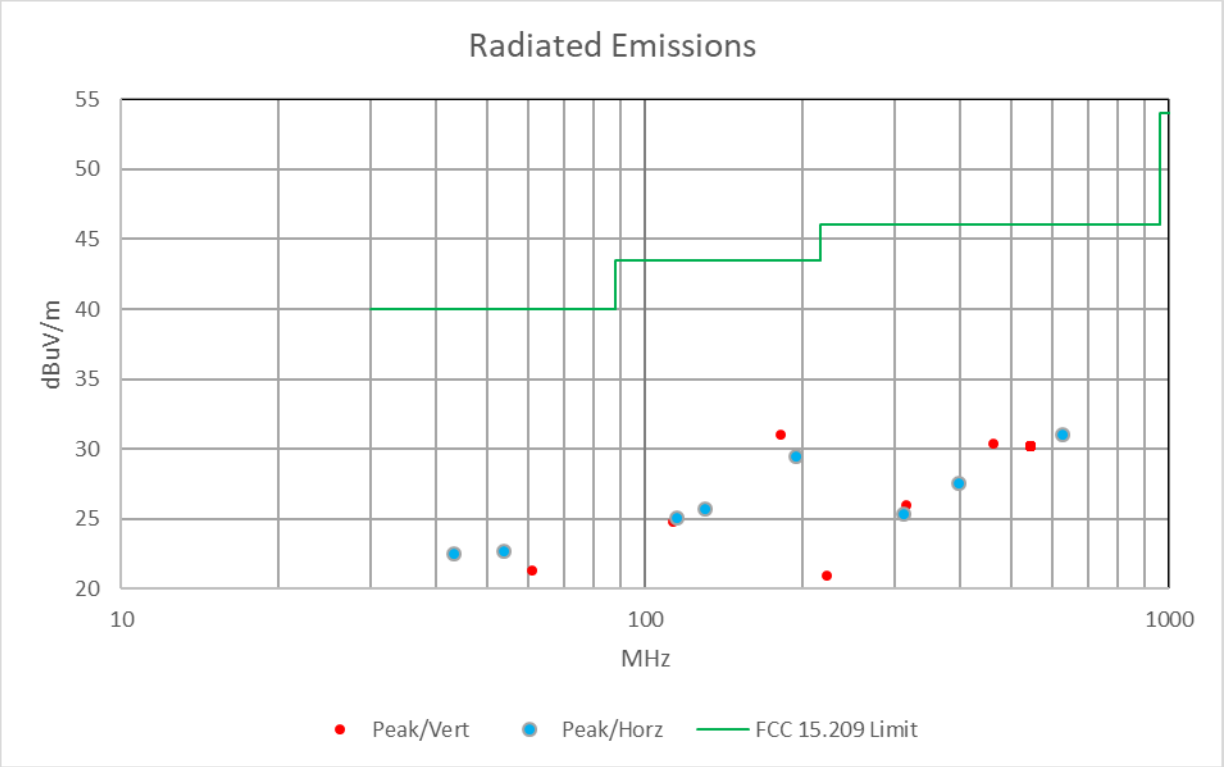
11.8.2 Radiated Emissions Test Results

Test Date	08/15/2018
Test Distance	3 Meters
Specification	FCC Part 15 Subpart C
Tested by	Joseph Strzelecki/ Richard Tichgelaar
Notes	Corr. Factors = Cable Loss – Preamp Gain External preamp used above 1 GHz
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; P = peak; Q = QP

Restricted band (15.205) Radiated emissions; Non Harmonics

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor	Cbl/amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
43.3	9.5	P	H	12.5	0.5	0.0	22.5	40.0	17.5	
53.7	9.6	P	H	12.5	0.6	0.0	22.7	40.0	17.3	
115.1	10.0	P	H	14.2	0.9	0.0	25.1	43.5	18.4	
130.2	10.6	P	H	14.2	0.9	0.0	25.7	43.5	17.8	
194.7	10.2	P	H	18.1	1.1	0.0	29.5	43.5	14.0	
311.7	9.8	P	H	14.1	1.4	0.0	25.3	46.0	20.7	
397.1	11.2	P	H	14.6	1.6	0.0	27.5	46.0	18.5	
627.5	9.9	P	H	19.1	2.1	0.0	31.0	46.0	15.0	
61.0	9.3	P	V	11.4	0.6	0.0	21.3	40.0	18.7	
113.4	9.9	P	V	14.0	0.9	0.0	24.8	43.5	18.7	
181.4	10.6	P	V	19.3	1.1	0.0	31.0	43.5	12.5	
221.9	9.2	P	V	10.5	1.2	0.0	20.9	46.0	25.1	
315.5	10.1	P	V	14.4	1.5	0.0	26.0	46.0	20.0	
462.7	12.2	P	V	16.4	1.8	0.0	30.4	46.0	15.6	
546.3	10.1	P	V	18.1	1.9	0.0	30.2	46.0	15.8	

Judgment: Passed by at least 10 dB



Radiated emissions in a graphical format. The above chart is the same data as the previous table.

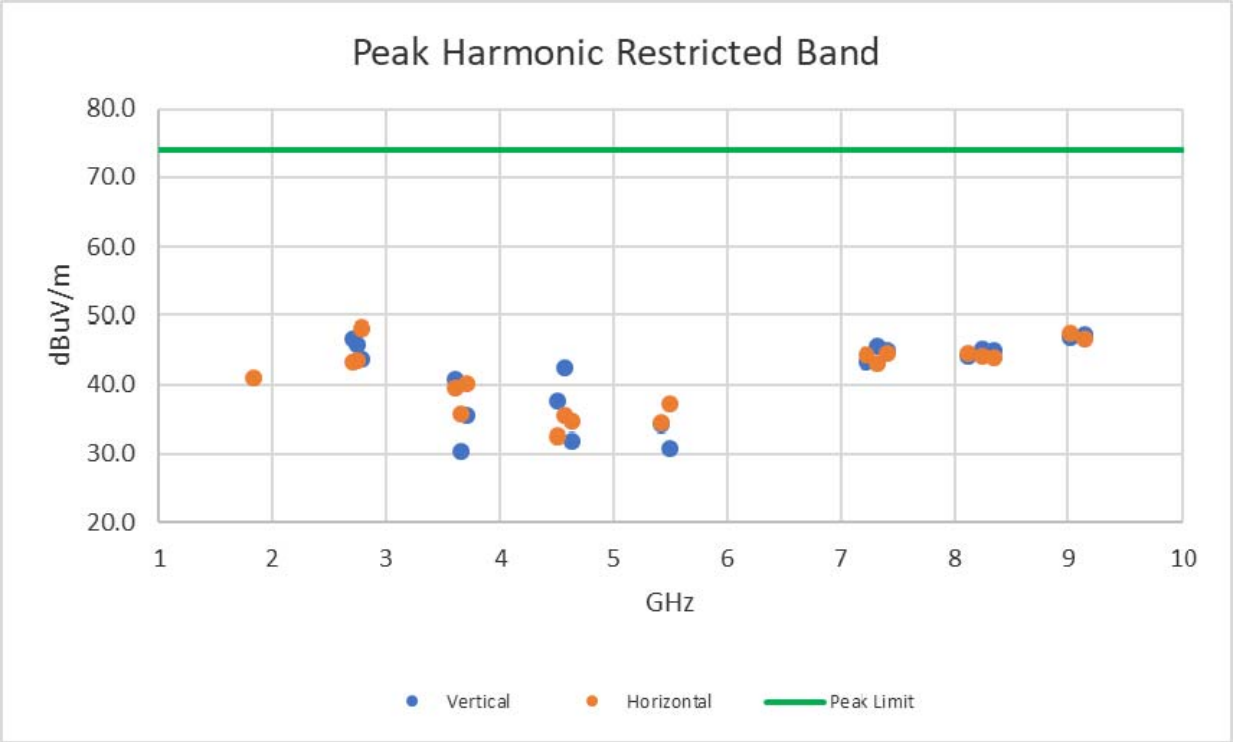
Restricted Band Harmonic Radiated emissions (15.205)

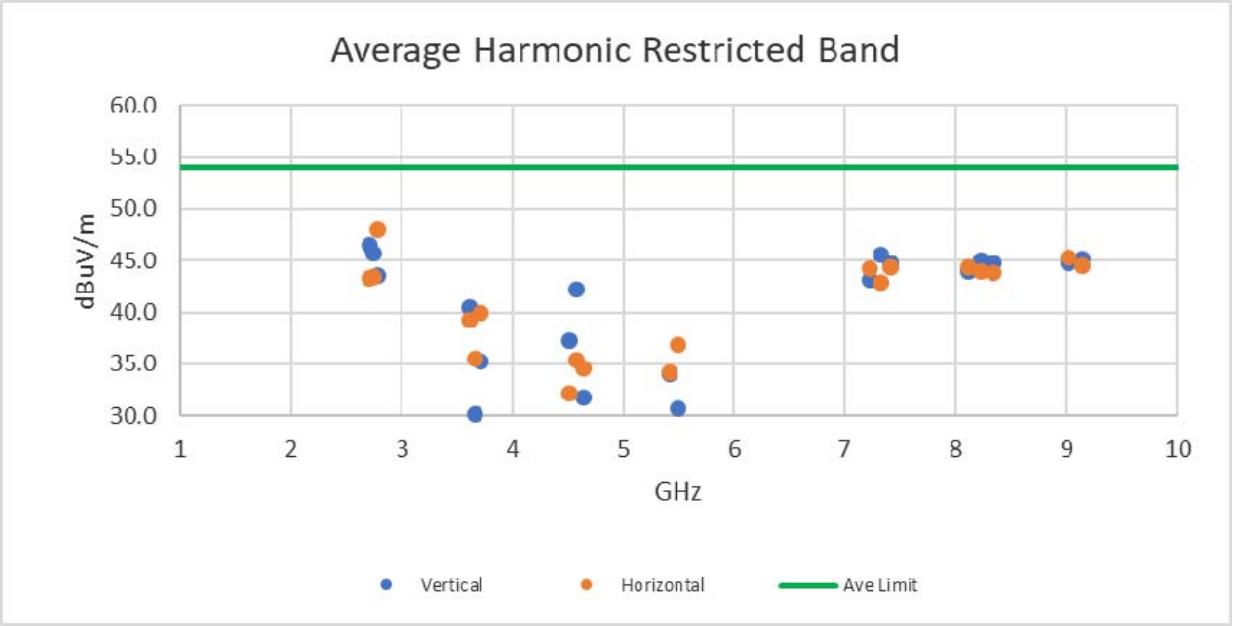
		Spectrum Analyzer Readings (dBuV)									EUT	Peak	Ave	Peak	Ave	Margin
hrm	Tx	Peak			Ave	Peak			Ave	Corr.	Emission	Tot. FS		Limit		Under
#	Freq MHz	Vertical Polarization				Horizontal Polarization				Fact. dB	Freq MHz	dBuV/m		dBuV/m		Limit dB
		X	Y	Z	Max	X	Y	Z	Max							
3	902	45.2	50.8	43.5	50.6	45.7	46.8	47.5	47.3	-4.1	2707.2	46.7	46.5	74	54	7.5
4	902	33.0	41.0	33.4	40.8	31.3	39.7	33.7	39.5	-0.3	3609.6	40.7	40.5	74	54	13.5
5	902	29.5	35.1	29.0	34.9	27.3	30.0	28.9	29.8	2.4	4512.0	37.5	37.3	74	54	16.7
6	902	28.8	27.8	28.4	28.6	28.7	27.3	29.0	28.8	5.4	5414.4	34.4	34.2	74	54	19.8
8	902	32.8	30.9	33.0	32.8	34.1	29.7	32.5	33.9	10.3	7219.2	44.4	44.2	74	54	9.8
3	915	46.1	50.1	44.6	49.9	31.6	44.3	47.8	47.6	-4.2	2745.0	45.9	45.7	74	54	8.3
4	915	27.9	30.4	30.3	30.2	27.3	35.7	33.3	35.5	0.0	3660.0	35.7	35.5	74	54	18.5
5	915	28.4	39.7	25.7	39.5	24.0	32.8	26.7	32.6	2.7	4575.0	42.4	42.2	74	54	11.8
8	915	33.6	34.8	30.0	34.6	32.1	30.4	29.8	31.9	10.9	7320.0	45.7	45.5	74	54	8.5
3	927	48.0	47.0	43.4	47.8	48.1	48.4	52.3	52.1	-4.2	2780.4	48.1	47.9	74	54	6.1
4	927	27.4	35.1	28.8	34.9	27.6	27.9	39.8	39.6	0.3	3707.2	40.1	39.9	74	54	14.1
5	927	29.0	28.0	27.6	28.8	26.7	31.8	28.5	31.6	2.9	4634.0	34.7	34.5	74	54	19.5
8	927	33.4	30.3	30.1	33.2	32.8	30.9	33.0	32.8	11.6	7414.4	45.0	44.8	74	54	9.2
Column numbers (see below for explanations)																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Column #1. hrm = Harmonic; BE = Band Edge emissions
Column #2. Frequency of Transmitter.
Column #3. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #4. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #5. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #6. Average Reading based on peak reading reduced by the Duty cycle correction
Column #7. Uncorrected readings from the spectrum analyzer with First Axis Rotation.
Column #8. Uncorrected readings from the spectrum analyzer with Second Axis Rotation.
Column #9. Uncorrected readings from the spectrum analyzer with Third Axis Rotation.
Column #10. Average Reading based on peak reading reduced by the Duty cycle correction
Column #11. Corr. Factors = Cable Loss – Preamp Gain + Antenna Factor
Column #12. Frequency of Tested Emission
Column #13. Highest peak field strength at listed frequency.
Column #14. Highest Average field strength at listed frequency.
Column #15. Peak Limit.
Column #16. Average Limit.
Column #17. The margin (last column) is the worst case margin under the peak or average limits for that row.

Overall Judgment: Passed by 6.1 dB

No other Emissions were detected from 30 to 9300 MHz within 8 dB of the limits, in the restricted bands

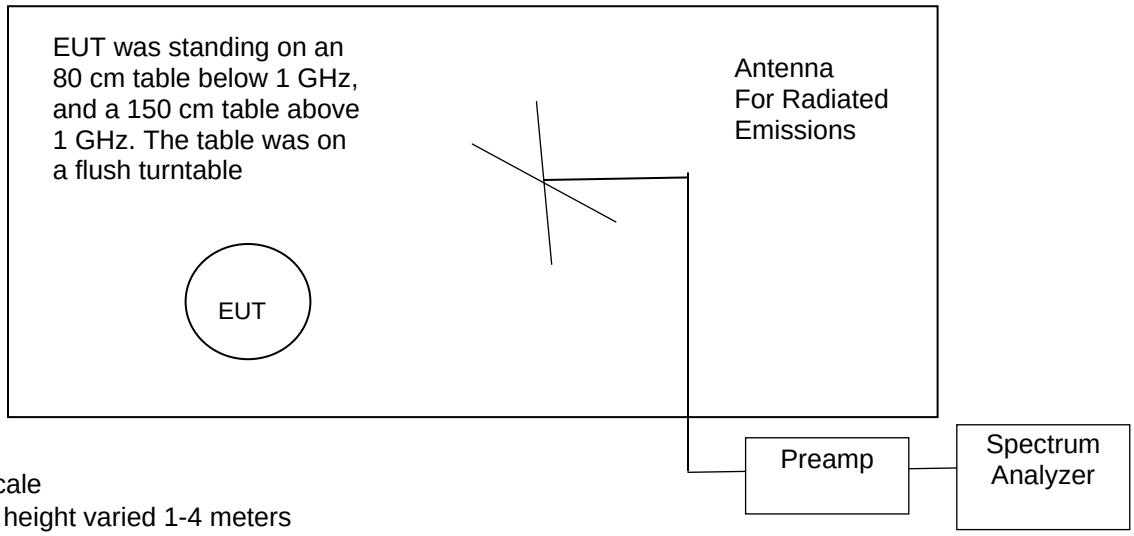




Radiated emissions in a graphical format. The above charts are the same data as the previous table.

Figure 2. Drawing of Radiated Emissions Setup

Chamber E, anechoic



Notes:
- Not to Scale
- Antenna height varied 1-4 meters
- Distance from antenna to tested system is 3 meters
- AC cords not shown. They are connected to AC outlet with low-pass filter on turntable

Frequency Range	Receive Antenna	Pre-Amplifier	Spectrum Analyzer	High Pass Filter
30 to 200 MHz	ANT-04	Internal	REC-21	None*
200 to 1000 MHz	ANT-06	Internal	REC-21	None*
1 to 10 GHz	ANT-13	AMP-05	REC-21	HPF-07

* A high pass filter was not needed since the fundamental frequency was outside of the amplifiers pass band.

11.9 Unintentional Emissions (Receive Mode)

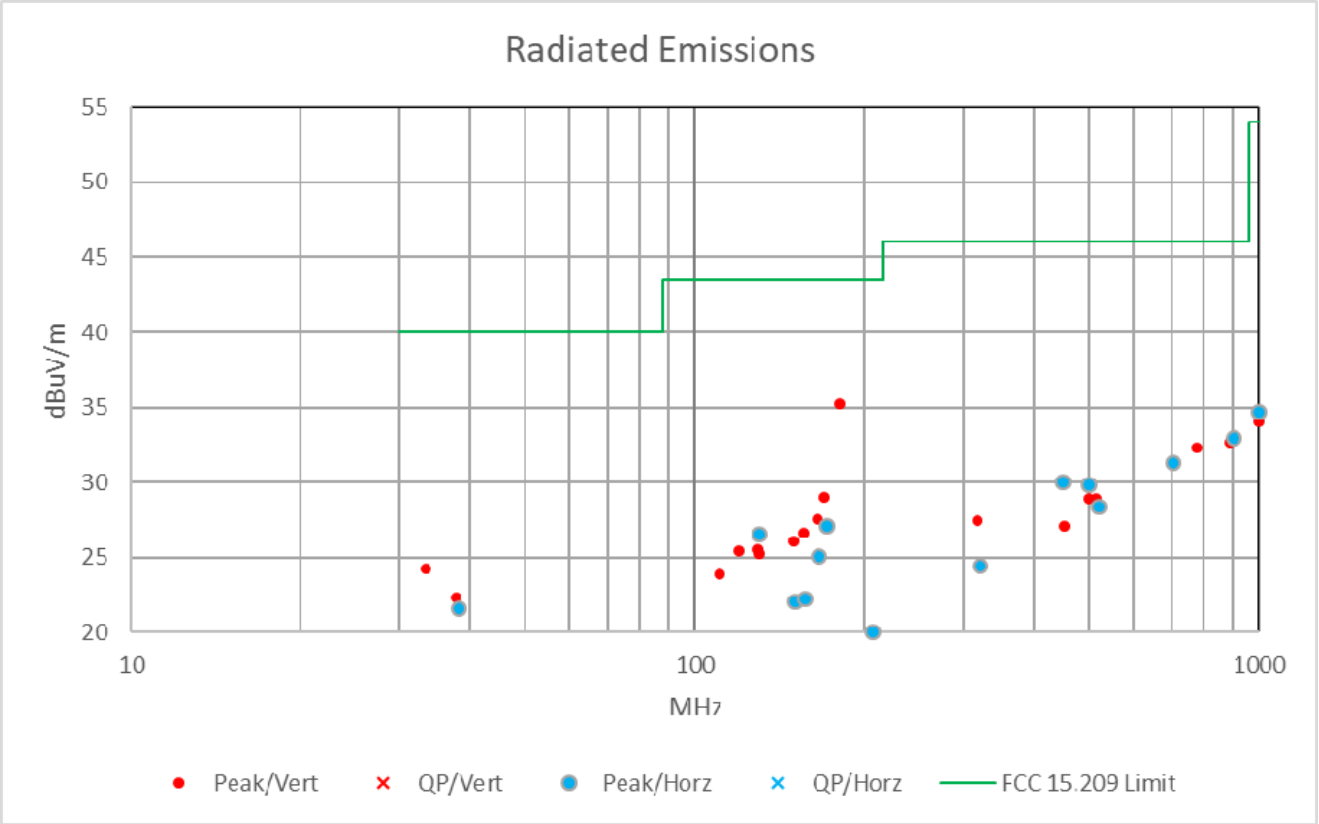
Manufacturer	New Cosmos Electric Co., Ltd.	Specification	FCC Part 15.209
Model	ML-310CE	Test Date	08/16 & 9/26/2018
Serial Number	none	Test Distance	3 Meters
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; P = peak; Q = QP		
Notes	Corr. Factors = Cable Loss – Preamp Gain External preamp used above 1 GHz		
Configuration	Receive mode		

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor	Cbl/amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
38.2	9.1	P	H	12.0	0.5	0.0	21.6	40.0	18.4	
130.6	11.5	P	H	14.1	0.9	0.0	26.5	43.5	17.0	
150.6	7.6	P	H	13.4	1.0	0.0	22.0	43.5	21.5	
157.1	7.0	P	H	14.1	1.0	0.0	22.2	43.5	21.3	
165.6	7.9	P	H	16.1	1.1	0.0	25.1	43.5	18.4	
172.1	8.1	P	H	17.9	1.1	0.0	27.1	43.5	16.4	
206.8	8.1	P	H	10.7	1.2	0.0	20.0	43.5	23.5	

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor	Cbl/amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
321.6	8.8	P	H	14.1	1.5	0.0	24.4	46.0	21.6	
449.1	12.6	P	H	15.7	1.8	0.0	30.0	46.0	16.0	
502.0	10.5	P	H	17.5	1.9	0.0	29.8	46.0	16.2	
521.3	9.2	P	H	17.2	1.9	0.0	28.4	46.0	17.6	
707.5	8.5	P	H	20.6	2.2	0.0	31.3	46.0	14.7	
906.3	8.5	P	H	21.8	2.6	0.0	32.9	46.0	13.1	
1000.0	8.8	P	H	23.2	2.7	0.0	34.7	54.0	19.3	1
1322.5	40.6	P	H	25.1	-34.3	0.0	31.4	74.0	42.6	1
1617.5	40.9	P	H	25.3	-34.4	0.0	31.8	74.0	42.2	1
2000.0	40.3	P	H	27.2	-34.0	0.0	33.5	74.0	40.5	1
2090.0	39.8	P	H	27.5	-33.9	0.0	33.3	74.0	40.7	1
2415.0	40.8	P	H	28.4	-33.8	0.0	35.4	74.0	38.6	1
2957.5	41.6	P	H	29.9	-33.2	0.0	38.3	74.0	35.7	1
33.4	12.8	P	V	11.0	0.5	0.0	24.2	40.0	15.8	
37.7	9.9	P	V	11.9	0.5	0.0	22.3	40.0	17.7	
73.9	11.1	P	V	7.9	0.7	0.0	19.7	40.0	20.3	
75.6	9.4	P	V	7.9	0.7	0.0	18.0	40.0	22.0	
110.8	9.3	P	V	13.7	0.8	0.0	23.9	43.5	19.6	
119.9	10.0	P	V	14.6	0.9	0.0	25.4	43.5	18.1	
129.8	10.3	P	V	14.2	0.9	0.0	25.5	43.5	18.0	
130.6	10.2	P	V	14.1	0.9	0.0	25.2	43.5	18.3	
150.4	11.7	P	V	13.4	1.0	0.0	26.1	43.5	17.4	
156.4	11.6	P	V	13.9	1.0	0.0	26.6	43.5	16.9	
165.0	10.6	P	V	15.9	1.1	0.0	27.5	43.5	16.0	
170.2	10.5	P	V	17.4	1.1	0.0	29.0	43.5	14.5	
180.9	14.8	P	V	19.3	1.1	0.0	35.2	43.5	8.3	
202.3	7.5	P	V	10.8	1.2	0.0	19.4	43.5	24.1	
317.8	11.7	P	V	14.2	1.5	0.0	27.4	46.0	18.6	
451.4	9.7	P	V	15.7	1.8	0.0	27.1	46.0	18.9	
499.7	9.6	P	V	17.4	1.9	0.0	28.9	46.0	17.1	
513.8	9.1	P	V	17.9	1.9	0.0	28.9	46.0	17.1	
776.3	8.8	P	V	21.2	2.4	0.0	32.3	46.0	13.7	
887.5	8.5	P	V	21.6	2.5	0.0	32.7	46.0	13.3	
1000.0	8.2	P	V	23.2	2.7	0.0	34.0	54.0	20.0	1
1005.0	39.3	P	V	24.1	-34.1	0.0	29.3	74.0	44.7	1
1515.0	41.6	P	V	25.1	-34.3	0.0	32.3	74.0	41.7	1
1727.5	43.7	P	V	26.1	-34.3	0.0	35.5	74.0	38.5	1
1987.5	40.8	P	V	27.2	-34.0	0.0	34.0	74.0	40.0	1
2010.0	39.7	P	V	27.2	-34.0	0.0	32.9	74.0	41.1	1
2285.0	39.6	P	V	27.8	-34.0	0.0	33.4	74.0	40.6	1
2445.0	41.3	P	V	28.4	-33.7	0.0	36.0	74.0	38.0	1
2887.5	41.3	P	V	29.4	-33.2	0.0	37.5	74.0	36.5	1

Note 1: All Peak readings above 1 GHz were under the Average limits, so average readings are not required.

Judgment: Passed by 8.3 dB



Radiated emissions in a graphical format. The above chart is the same data as the previous table.

11.9.1 Measurement Instrumentation Uncertainty

Measurement	Uncertainty
Radiated Emissions, E-field, 3 meters, 30 to 200 MHz	3.3 dB
Radiated Emissions, E-field, 3 meters, 200 to 1000 MHz	4.9 dB
Radiated Emissions, E-field, 3 meters, 1 to 18 GHz	4.8 dB
Bandwidth using marker delta method at a span of 500 kHz	4 kHz
99% Occupied Bandwidth using REC-43	1% of frequency span
Conducted power at 915 MHz	0.8 dB
Amplitude measurement 1-10,000 MHz	1.5 dB
Temperature THM-02	0.6 Deg C

The uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2 in accordance with CISPR 16-4-2.